

Capital Budgeting and Investment Analysis

Chapter 26

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**Fundamental Accounting
Principles**

25th Edition

Chapter 26 Learning Objectives

ANALYTICAL

A1 Analyze a capital investment project using break-even time.

PROCEDURAL

P1 Compute payback period and describe its use.

P2 Compute accounting rate of return and explain its use.

P3 Compute net present value and describe its use.

P4 Compute internal rate of return and explain its use.

Capital Budgeting

Capital budgeting is the process of analyzing alternative long-term investments and deciding which assets to acquire or sell.

Capital Budgeting Process:

- 1. Manager submits a proposal.**
- 2. Capital budget committee evaluates proposal and recommends approval or rejection.**
- 3. Board of directors then approves capital investments for the year.**

Capital Budgeting Decisions

Capital budgeting decisions are usually the most difficult and risky decisions that managers make. Specifically, a capital budgeting decision is risky because:

1. Outcome is uncertain.

2. Large amounts of money are usually involved.

3. Investment involves a long-term commitment.

4. Decision may be difficult or impossible to reverse.

Capital Investment Cash Flows

Exhibit
26.2



Learning Objective P1

Compute payback period
and describe its use.

Payback Period

The payback period is the amount of time expected to recover the initial investment amount

$$\text{Payback period} = \frac{\text{Initial investment}}{\text{Annual net cash flow}}$$

Managers prefer projects with shorter payback periods.

Learning Objective P1: Compute payback period and describe its use.

Payback Period with Equal Cash Flows

Initial investment	\$16,000	Materials, labor, and overhead (except depreciation)	\$16,500
Useful life	8 years	Depreciation—Machinery	\$2,000
Salvage value	\$0	Selling, general, and administrative expenses	\$9,500
Expected sales per	1,000	Selling price per unit	\$30

Annual Results from Investment	Income	Cash Flow
Sales of new product (1,000 × \$30)	\$30,000	\$30,000
Expenses		
Materials, labor, and overhead (except depreciation)	16,500	16,500
Depreciation—Machinery [(\$16,000 - \$0)/8 years]	2,000	-
Selling, general and administrative expenses	<u>9,500</u>	<u>9,500</u>

Exhibit 26.3

$$\text{Payback period} = \frac{\text{Initial investment}}{\text{Annual net cash flow}} = \frac{\$16,000}{\$4,000} = 4 \text{ years}$$

Income *Net cash flow*

Exhibit 26.4

Learning Objective P1: Compute payback period and describe its use

Payback Period with Unequal Cash Flows

FasTrac wants to install a machine that costs \$16,000 and has an 8-year useful life with \$0 salvage value. Annual net cash flows are unequal as shown below:

To get the payback period when we have unequal annual net cash flows, we must add the cash flows each year until the total equals the cost of the investment

Year	Net Cash Flows per Year	Cumulative Net Cash Flows
Initial investment	\$(16,000)	\$(16,000)
Year 1	2,000	(14,000)
Year 2	4,000	(10,000)
Year 3	4,000	(6,000)
Year 4	4,000	(2,000)
Payback period = 4 years + (\$2,000/\$4,000) or 0.5 of Year 5 = <u>4.5 years</u>		

Exhibit
26.5

Payback occurs between Years 4 and 5.

Learning Objective P1: Compute payback period and describe its use

Evaluating the Payback Period

Payback period strengths:

1. Uses cash flows.
2. Easy to compute.

Payback period weaknesses:

1. Ignores cash flows after payback period.
2. Ignores the time value of money.

Learning Objective P2

Compute accounting
rate of return and
explain its use.

Accounting Rate of Return

Accounting rate of return (ARR) is an investment's annual income divided by the average amount invested in it.

Decision Rule: Select investment with highest accounting rate of return.

$$\text{Average investment} = \frac{\text{Initial investment} + \text{Salvage value}}{2} = \frac{\$16,000 + \$0}{2} = \$8,000$$

Exhibit
26.6

$$\text{Accounting rate of return} = \frac{\text{Annual income}}{\text{Average investment}} = \frac{\$2,000}{\$8,000} = \underline{\underline{25.0\%}}$$

Exhibit
26.7

Learning Objective P2: Compute accounting rate of return and explain its use.

Evaluating Accounting Rate of Return

Accounting Rate of Return has two weaknesses:

1. Ignores time value of money.
2. It does not directly consider cash flows and their timing.

Learning Objective P2: Compute accounting rate of return and explain its use.

Learning Objective P3

Compute net present value and describe its use.

Net Present Value

Net present value analysis applies the time value of money to future cash inflows and cash outflows so management can evaluate a project's desirability.

We calculate Net Present Value (NPV) by:

1. Discounting the future net cash flows from the investment at the required rate of return and
2. Subtracting the initial amount investment.

A company's required rate of return, often called its *hurdle rate*, is typically its cost of capital, which is an average of the rate the company must pay to its lenders and investors.

Learning Objective P3: Compute net present value and describe its use.

Net Present Value with Equal Cash Flows

A company is considering a \$20,000 investment in a machine that is expected to provide \$10,000 annual net cash flows for three years. The company requires a 9% annual return.

	Net Cash Flows	Present Value of 1 at 9%†	Present Value of Net Cash Flows
Year 1	\$10,000	0.9174	\$ 9,174
Year 2	10,000	0.8417	8,417
Year 3	<u>10,000</u>	0.7722	<u>7,722</u>
Totals	\$30,000		25,313
Initial investment			<u>(20,000)</u>
Net present value			<u>\$ 5,313</u>

† Present value of 1 factors are taken from Table B.1 in Appendix B.

* Cash flows occur at end of each year.

† Present value of 1 factors are taken from Table B.1 in Appendix B.

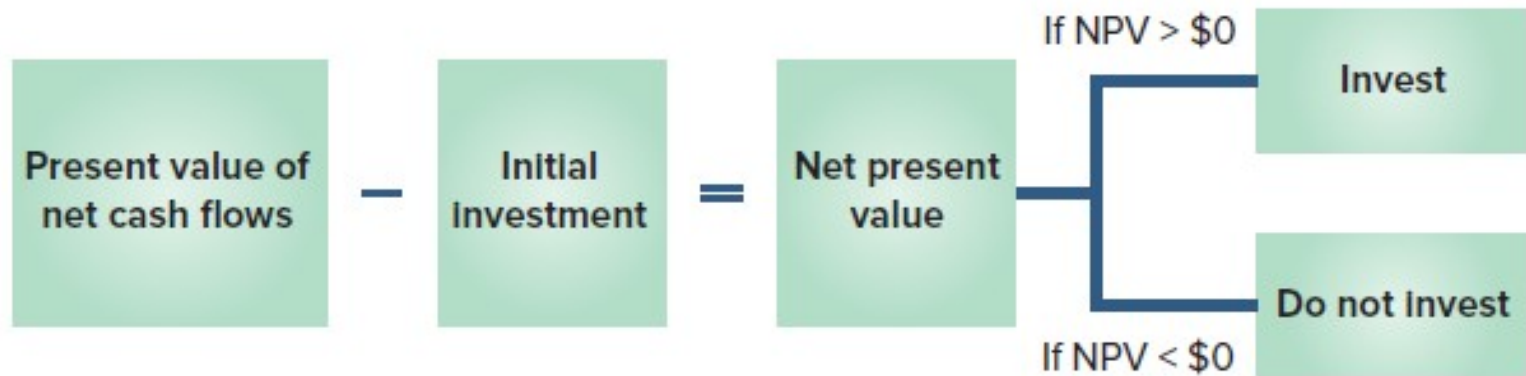
Exhibit
26.8

Decision Rule:
NPV > 0 then
invest

Learning Objective P3: Compute net present value and describe its use.

Net Present Value Decision Rule

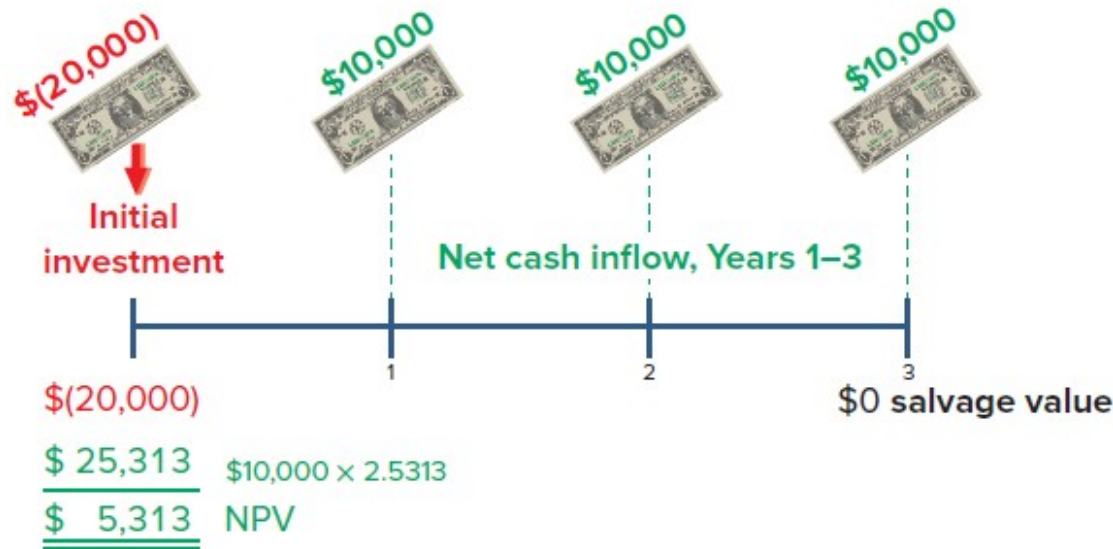
When an asset's expected net cash flows yield a positive net present value, then invest in the project.



When comparing investment projects of similar cost and risk, invest in the one with the highest positive net present value.

Net Present Value - Annuity Assumption

- Can simplify the present value calculations if there is a series of equal cash flows.
- Series of cash flows of equal amounts is called an annuity.
- Use Table B.3 to compute present value.



Learning Objective P3: Compute net present value and describe its use.

Net Present Value - Applying Annuity Assumption to Strategic Plans

- NPV analysis can be used to decide whether to automate a production process.
- Example: Manufacturer is considering investing in an \$80,000 automated manufacturing system.
- Investment can reduce labor costs by \$15,000 per year for 10 years.
- Company will use 10% discount rate and \$0 salvage

	Net Cash Flows	Present Value of an Annuity at 10%†	Present Value of Net Cash Flows
Years 1-10	\$15,000	6.1446	\$ 92,169
Initial investment			<u>(80,000)</u>
Net present value			<u>\$ 12,169</u>

Exhibit 26.9

†6.1446 is the present value of an annuity of 1, where $n = 10$, $i = 10\%$ (from Table B-3).

Learning
describe its use.

Net Present Value with Unequal Cash Flows

	<u>Net Cash Flows</u>		<u>Present Value of 1 at</u>	<u>Present Value of Net Cash Flows</u>	
	A	B		A	B
Year 1	\$ 5,000	\$ 8,000	0.9091	\$ 4,546	\$ 7,273
Year 2	5,000	5,000	0.8264	4,132	4,132
Year 3	5,000	2,000	0.7513	3,757	1,503
Totals	\$15,000	\$15,000		12,435	12,908
	0				
Initial investment				(12,000)	(12,000)
Net present				\$ 435	\$ 908

Exhibit
26.10

Although both projects require the same \$12,000 investment and have the same total net cash flows, Project B has a higher net present value because of a larger net cash flow in Year 1.

Learning Objective P3: Compute net present value and describe its use.

Net Present Value- Investments with Salvage Value

	Net Cash Flows	Present Value of Factor at 10%*	Present Value of Net Cash Flows
Years 1-10	\$ 15,000	6.1446	\$ 92,169
Salvage value at Year 10	10,000	0.3855	3,855
Total			\$ 96,024
Initial investment			(80,000)
Net present value			\$ 16,024

*6.1446 = Present value of an annuity of 1, where $n = 10$, $i = 10\%$ (from Table B.3).

3,855 = Present value of 1, where $n = 10$, $i = 10\%$ (from Table B.1).

Salvage is an additional net cash inflow expected to be received at the end of the asset's life.

Learning Objective P3: Compute net present value and describe its use.

Comparing NPV Projects

Use profitability index to rank projects of similar initial investment amounts and risk levels.

$$\text{Profitability index} = \frac{\text{Present value of net cash flows}}{\text{Initial investment}}$$

Potential investment	1	2	3
Present value of net cash flows	\$900,000	\$375,000	\$270,000
Initial investment	750,000	250,000	300,000
Profitability index	1.2	1.5	0.9

Exhibit
26.11

Investment #2 has the highest profitability index so it should be chosen.

Profitability index < 1 indicates a negative NPV, so Investment #3 would be ruled out.

Learning Objective P3: Compute net present value and describe its use.

Learning Objective P4

Compute internal rate of return and explain its use.

Internal Rate of Return (IRR)

The discount rate that yields a NPV of zero.

1. Compute present value factor for investment project.

$$\text{Present value factor} = \frac{\text{Initial investment}}{\text{Annual net cash flows}}$$

2. Identify discount rate (IRR) yielding the present value factor.

Internal Rate of Return (IRR) – Equal Cash Flows

Step 1. Compute present value factor for the investment project.

$$\text{Present value factor} = \frac{\text{Initial investment}}{\text{Annual net cash flows}} = \frac{\$12,009}{\$5,000} = 2.4018$$

Step 2. Identify the discount rate (IRR) yielding the present value factor.

Present Value of an Annuity of 1 for Three Periods					
Discount Rate					
Periods	1%	5%	10%	12%	15%
3	2.9410	2.7232	2.4869	2.4018	2.2832

Learning Objective P4: Compute internal rate of return and explain its use.

Using Internal Rate of Return (IRR) - Unequal Cash Flows

When we use the IRR to evaluate a project, we compare the internal rate of return to the predetermined hurdle rate (minimum acceptable rate of return).

Decision rule: If $IRR > \text{hurdle rate}$: invest.

Internal rate of return

>

Hurdle rate



Invest

Internal rate of return

<

Hurdle rate



Do not invest

Comparing of Capital Budgeting Methods

Exhibit
26.12

	Payback Period	Accounting Rate of Return	Net Present Value	Internal Rate of Return
Focus	• Cash flows	• Income	• Cash flows	• Cash flows
Yields	• Years	• Percent	• Dollars	• Percent
Strengths	• Easy to compute	• Easy to compute	• Reflects time value of money • Reflects changing risks over project's life	• Reflects time value of money • Allows comparisons of projects
Weaknesses	• Ignores time value of money • Ignores cash flows after payback period	• Ignores time value of money • Ignores cash flows	• Harder to compare projects	• Ignores changing risks over project's life

Learning Objective 4: Compute internal rate of return and explain its use.

Learning Objective A1

Analyze a capital investment project using break-even time.

Break-Even Time (BET)

Break-even time is a measure of the expected time until the present value of the net cash flows from an investment equals the initial investment.

Exhibit
26.14

Year	Net Cash Flows	Present Value of 1 at 10%*	Present Value of Net Cash Flows	Cumulative Present Value of Net Cash Flows
Initial investment	\$(12,000)	1.0000	\$(12,000)	\$(12,000)
1.....	4,100	0.9091	3,727	(8,273)
2.....	4,100	0.8264	3,388	(4,885)
3.....	4,100	0.7513	3,080	(1,805)
4.....	4,100	0.6830	2,800	995
5.....	4,100	0.6209	2,546	3,541

Break-even time

Net present value

*Present value of 1 factors from Table B.1 in Appendix B.

Learning Objective A1: Analyze a capital investment project using break-even time.

Learning Objective

Appendix 26A
Using Excel to Compute
Internal Rate of Return.

Using Excel to Compute IRR

Computing present values and internal rates of return for projects with uneven cash flows is tedious and error prone. These calculations can be performed simply and accurately by using functions built into Excel.

	A	B	C
1	Initial investment		-16000
2	Annual cash flows received at year-end		
3		1	3000
4		2	4000
5		3	4000
6		4	4000
7		5	5000
8		6	3000
9		7	2000
10		8	2000
11			=IRR(C1:C10)

End of Chapter 26